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SEASONAL MOVEMENTS AND MORTALITY ESTIMATES OF BURBOT IN WESTERN LAKE SUPERIOR

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ABSTRACT

Burbot (Lota lota) were studied in western Lake Superior to describe seasonal movements and estimate mortality. Burbot began concentrating off river mouths in late fall prior to making spawning runs up two known spawning rivers. After spawning in late December and early January, fish moved downstream and were concentrated inshore from February to early July. The fish moved eastward during the early summer, moved offshore in late summer, and returned to spawning rivers in the fall. Total annual mortality was estimated at 43%.

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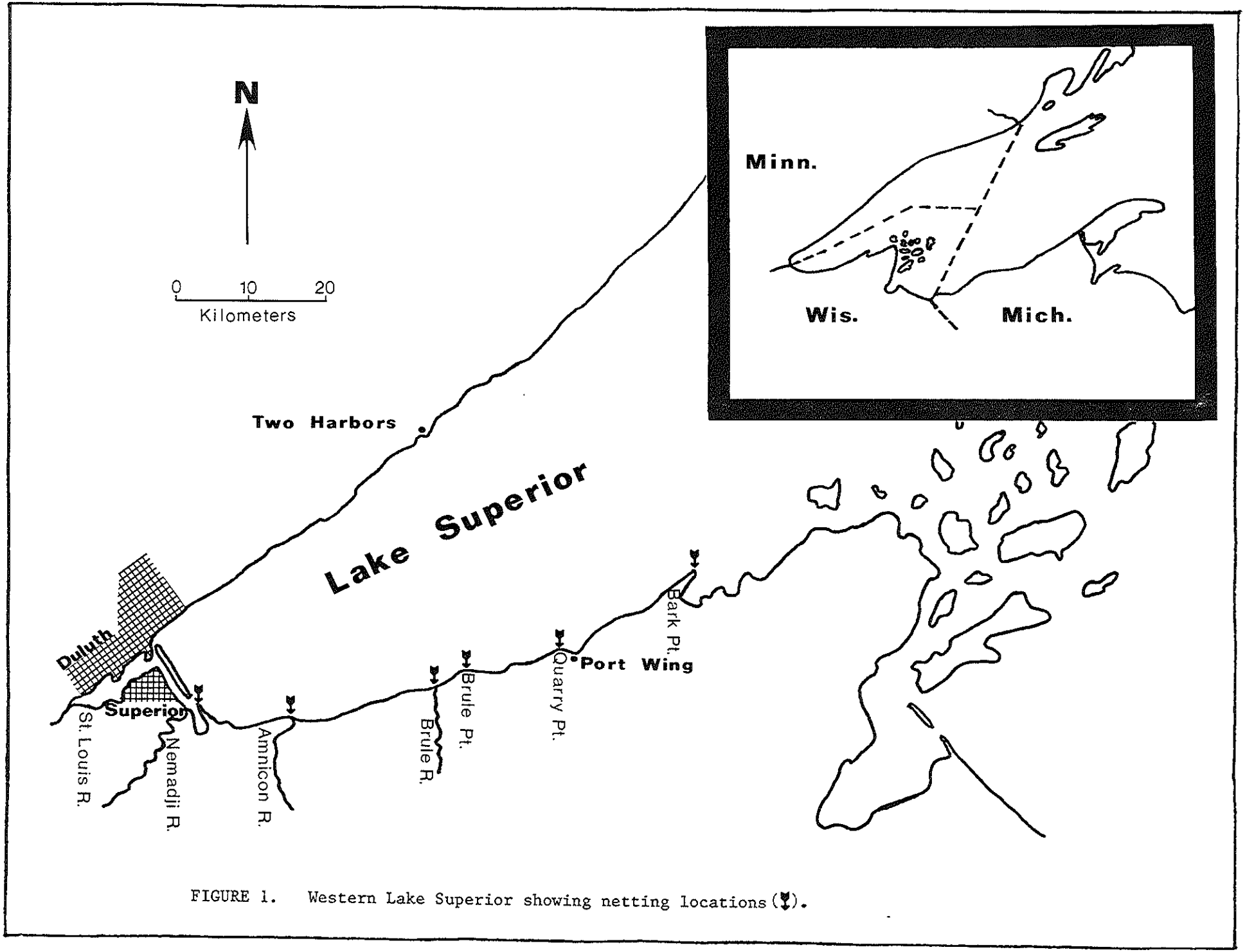

FIGURE 1. Western Lake Superior showing netting locations (Ψ).

TABLE 1. Frequency of average burbot lengths for different age groups from western Lake Superior, 1979-82.

	Age Group											
Length (mm)	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
276-300	1											
301-325	2	2	1									
326-350	2	7	2	1								
351-375		5	4	6	3							
376-400	1	4	11	12	3							
401-425		2	3	11	12	1						
426-450			3	14	12	2						
451-475			3	8	13	7	2					
476-500				6	8	8	4	1				
501-525				3	9	10	5	5				
526-550				2	12	9	4	3	1			
551-575				2	7	8	10	7	1			
576-600					4	7	5	3	3	1		
601-625					1	6	6	2	2	2		
626-650						1	1	2	2	2		
651-675							1	1		2	1	
676-700							1	2	2	3		
701-725										2	1	1
726-750												
751-775												
776-800												1
Total Fish	6	20	28	65	84	59	39	26	11	12	2	2
Mean Length	329	359	398	435	481	531	560	573	613	661	698	751
Increment of Mean	329	30	39	37	46	40	29	13	40	48	37	53

TABLE 2. Mean total length of burbot from several North American Lakes.

	Length by Age Group (mm)													
Locations and Reference	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
Lake Erie* (Clemens 1951b)	210	323	377	424	492	540	558	579	591	616				
Southwestern Lake Superior (Bailey 1972)	254	300	340	376	409	439	478	513	551	594	645	711		
Lake of the Woods (Muth and Smith 1974)	129	288	399	481	534	578	614	648	676	696	713	727	746	
Lake Winnipeg (Hewson 1955)			411	490	526	531	554	587	632	668	721	782	795	787
Western Lake Superior (Present Study)			329	359	398	435	481	531	560	573	613	661	698	751

*Reported as mean standard length.

et al. (1965) felt that surface currents had a principal influence on movements of stocked lake trout in Lake Superior. Smith and Van Oosten (1939) reported one tagged burbot that moved 17 km in Lake Michigan.

Summer Distribution

Limited data were collected on burbot distribution from July to October since they were not readily caught in the trap net. Tagged fish moving eastward in early summer were recaptured in the Nemadji and Amnicon rivers the following spawning season, indicating a westward movement sometime during this period (Fig. 2). It was not determined if this movement was along the shore or in deeper water. Burbot have generally been described as inhabiting deep water during the summer (Scott and Crossman 1973).

Adult burbot have been found along the Minnesota shore during the summer and juveniles have been collected in tributary streams (Charles Krueger, DNR, pers. comm. 1983), but no known spawning populations exist. These data suggest a single stock of burbot may exist within the eddy (Fig. 2) at the western end of the lake. No information was collected on the distribution of immature burbot because they were not susceptible to the sampling techniques (because of net mesh size and sampling location).

MORTALITY ESTIMATES

Total Annual Mortality

The number of aged burbot was expanded to the entire sample of aged and nonaged fish to make a catch curve and estimate total annual mortality. Total annual mortality during 1979-1982 was calculated to be 43%. For comparison, I calculated total annual mortality estimates using data published from two other Great Lakes studies (Clemens 1951b, Bailey 1972) and found similar rates (Table 3). Mortality estimates from Lake of the Woods were higher (64%) due to exploitation by a commercial fishery (Muth and Smith 1974).

TABLE 3. Burbot mortality estimates from several North American Lakes.

Location and Reference	Fishing Mortality (%)	Natural Mortality (%)	Total Mortality (%)	Instantaneous Rate of Mortality
Lake of the Woods (Muth and Smith 1974)	42	38	64	0.99
Southwestern Lake Superior (Bailey 1972)	--	--	39	0.49
Lake Erie (Clemens 1951b)	--	--	40	0.51
Western Lake Superior (Present Study)	--	--	43	0.56

Data from western Lake Superior indicated burbot occupy inshore waters for at least five months of the year. In addition to competing with lake trout for food, burbot probably compete considerably with other inshore piscivorous species between February and June. Although no quantitative food habit studies were undertaken, I found burbot preying on newly stocked lake trout at Superior. The day after stocking, 17 of 25 burbot had eaten a total of 91 lake trout. The third day after stocking, an analysis of 19 burbot stomachs failed to find any lake trout. With large concentrations of burbot at a trout stocking site, especially within the confines of piers, initial mortality from burbot could be significant. To deter burbot predation in western Lake Superior, offshore lake trout stocking should be considered.

A large burbot population presumably exists in western Lake Superior as a result of low fishing mortality and reduced sea lamprey predation (due to chemical control). Based on distribution of the burbot, its population characteristics, and its competition with more important species for food and habitat, an expanded fishery would seem economically and biologically desirable.

While past marketing difficulties have limited burbot harvest commercially, Lindsay et al. (1981) reported new marketing techniques with potential use of burbot fillets. Also, increasing regional popularity in the burbot sport fishery suggests acceptance of this species as a food fish may be increasing.

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